The Large Plasma Chamber

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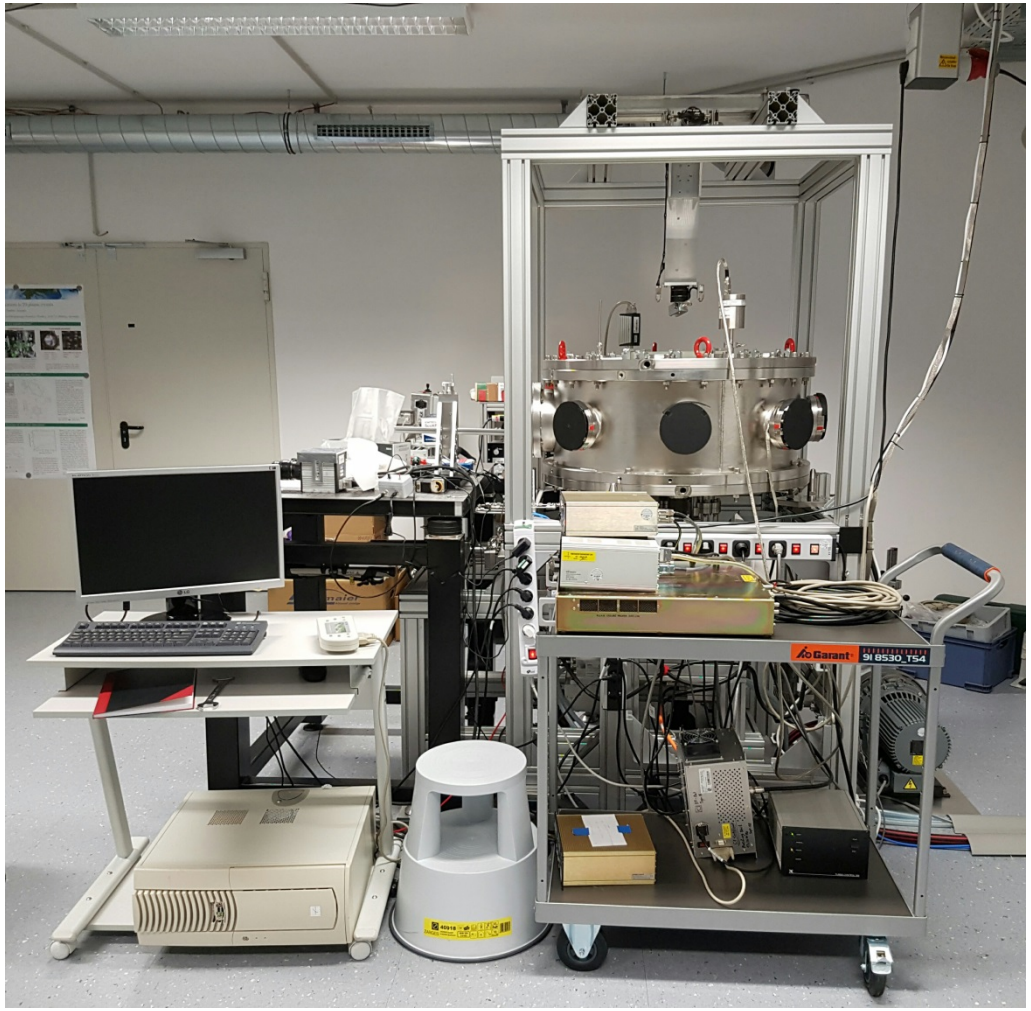
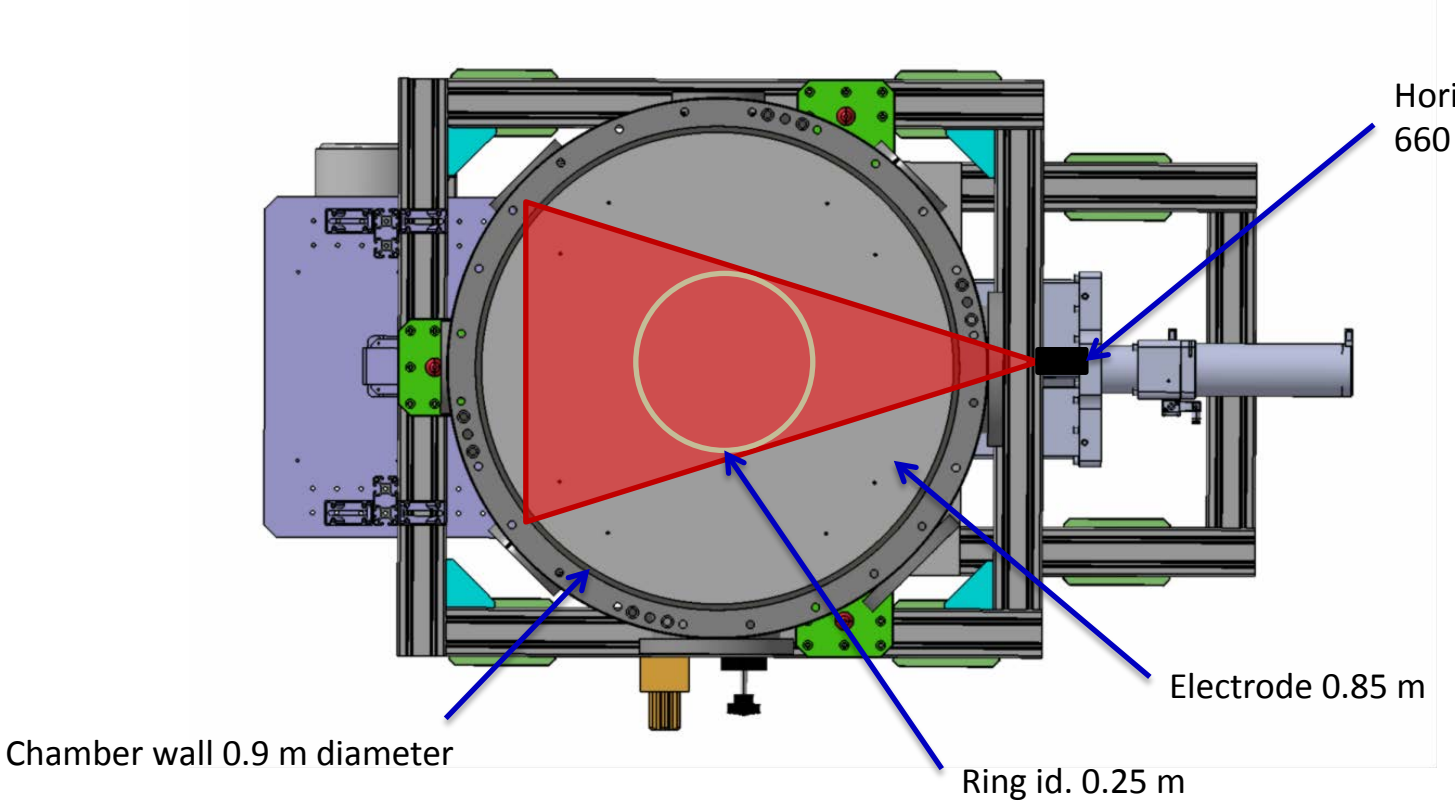
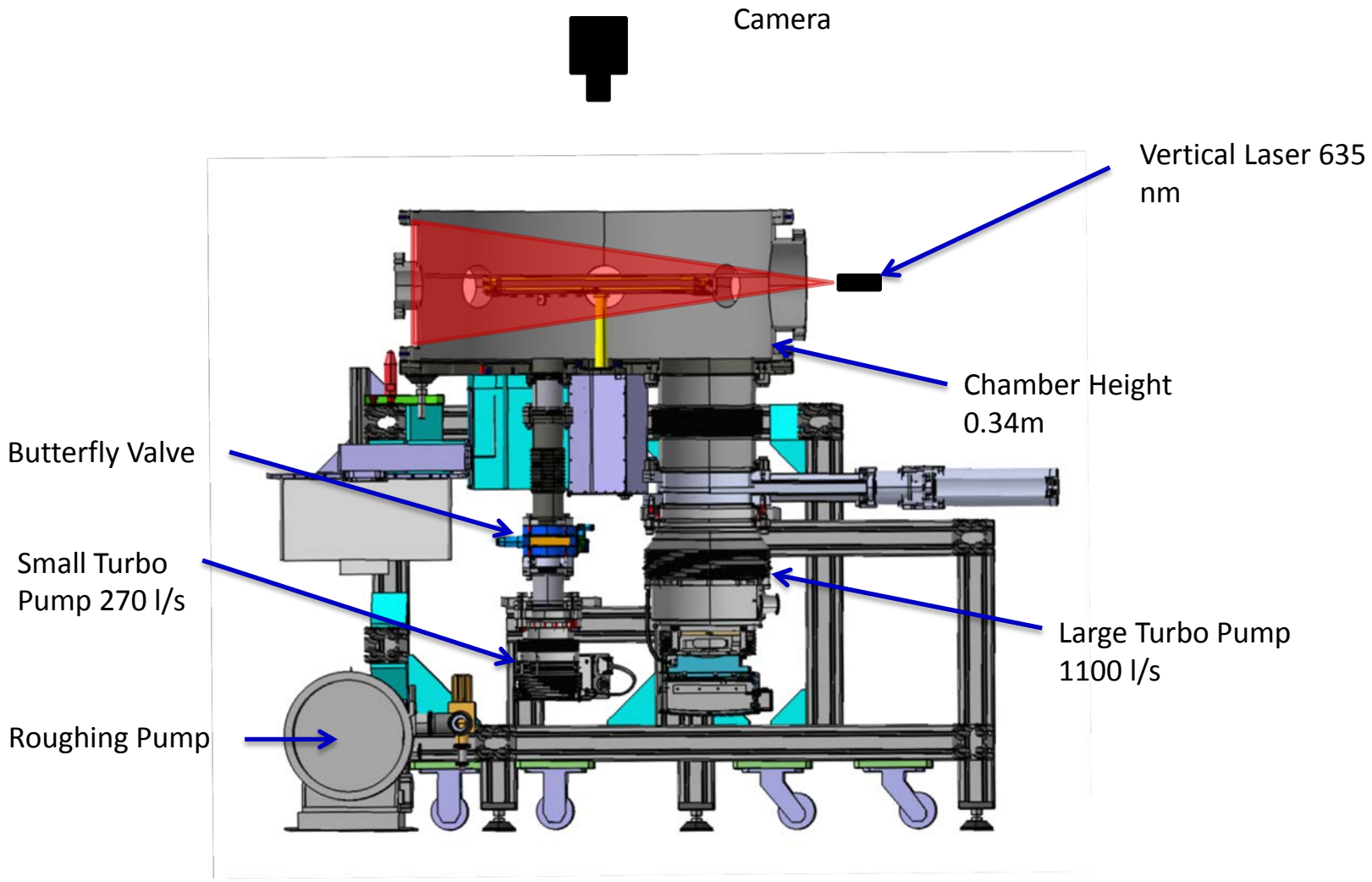
Special thanks to:
Vladimir Nosenko, Hubertus Thomas

Large Chamber Setup at DLR

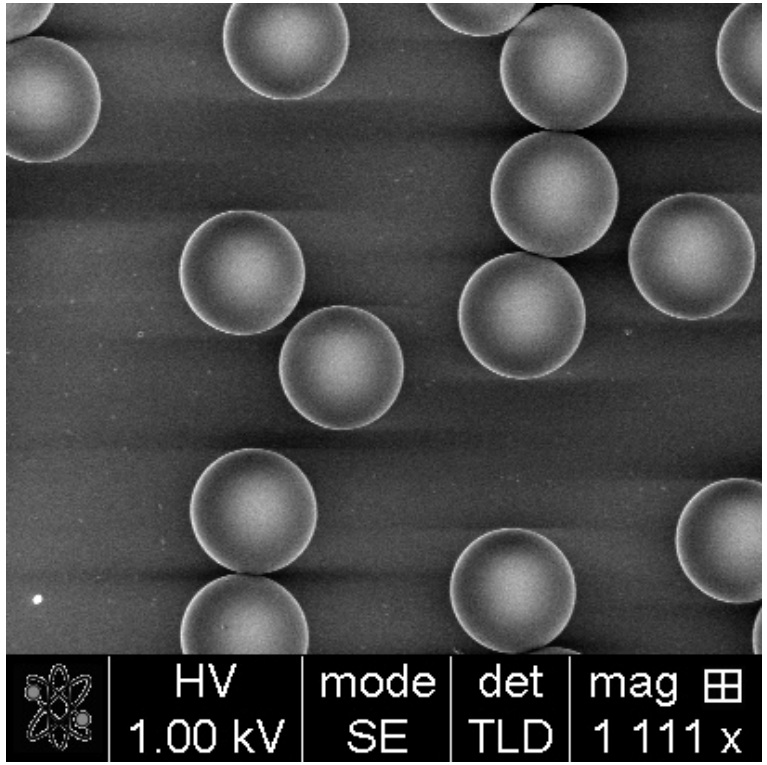


Setup Diagram




Camera
Vertical Laser 635 nm
Chamber Height 0.34m
Butterfly Valve
Small Turbo Pump 270 l/s
Large Turbo Pump 1100 l/s
Roughing Pump

Experimental Parameters



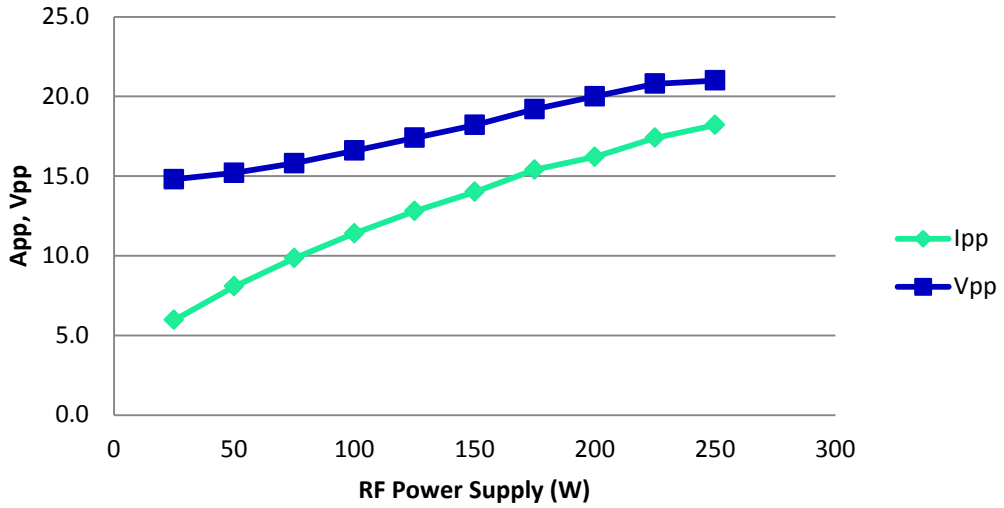
Polymer (MF) microspheres:

Diameter	$d \approx 9\ \mu m$
Charge	$Q \approx -2*10^4\ e$
Spacing	$a \approx 0.9\text{-}1.6$ mm
Number	$\approx 14{,}000$

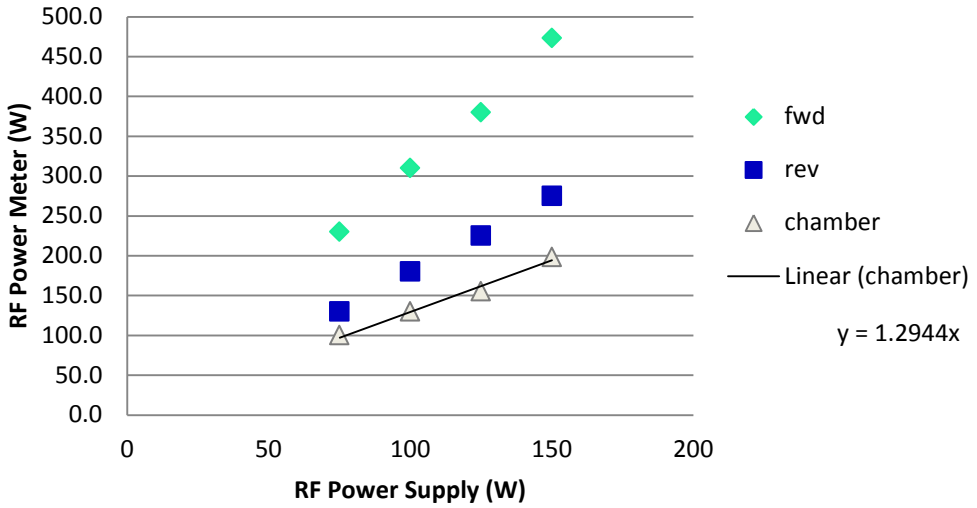
Argon RF plasma:

pressure	2.50-5.00 Pa
RF power	100-420 W
Self Bias	-10- -40 V

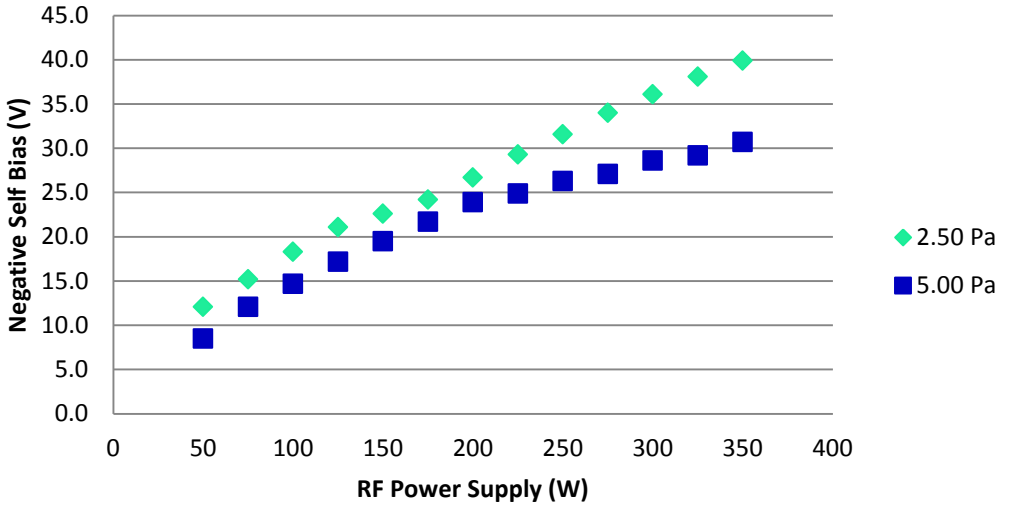
Electrode Current and Voltage

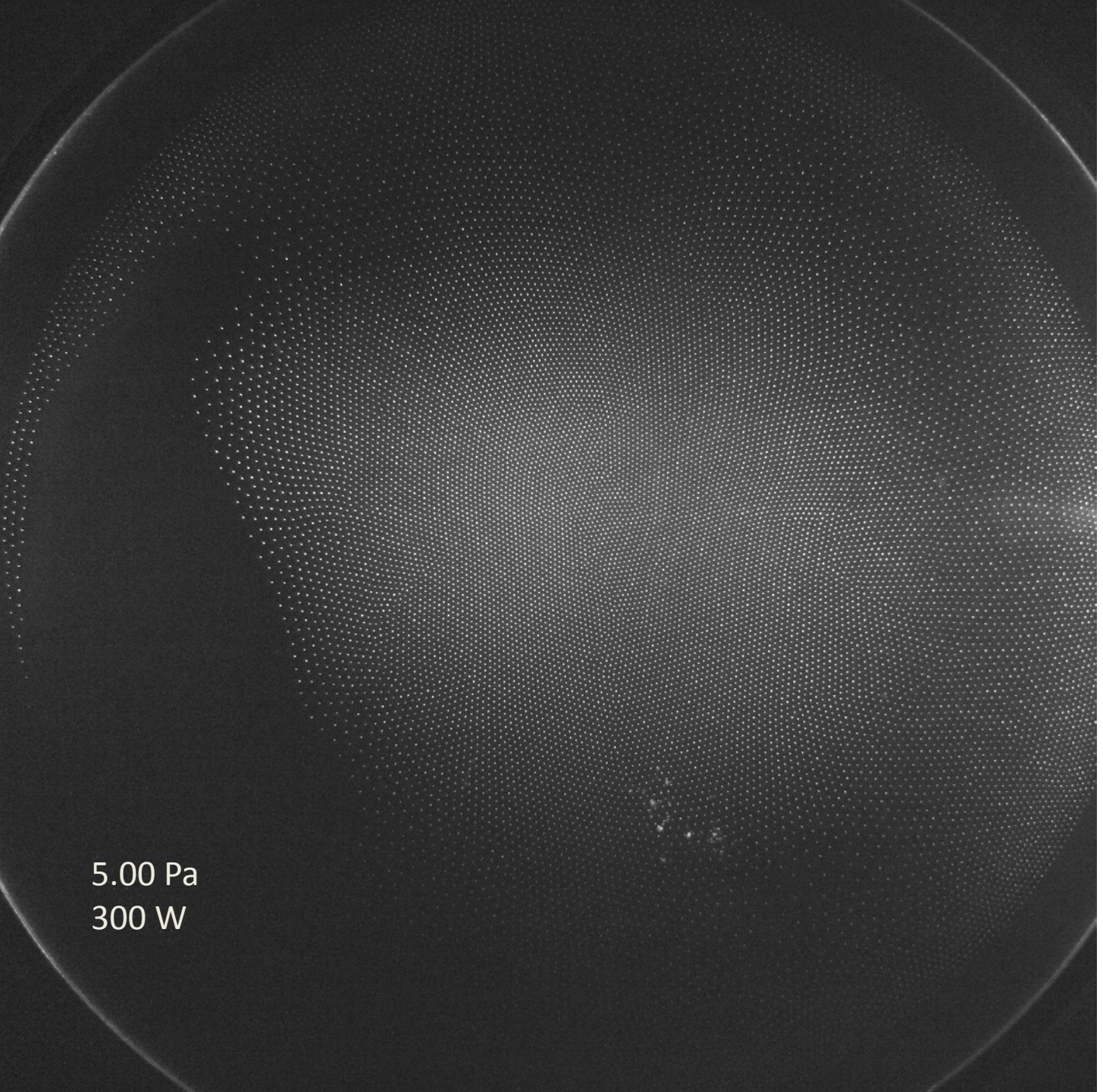


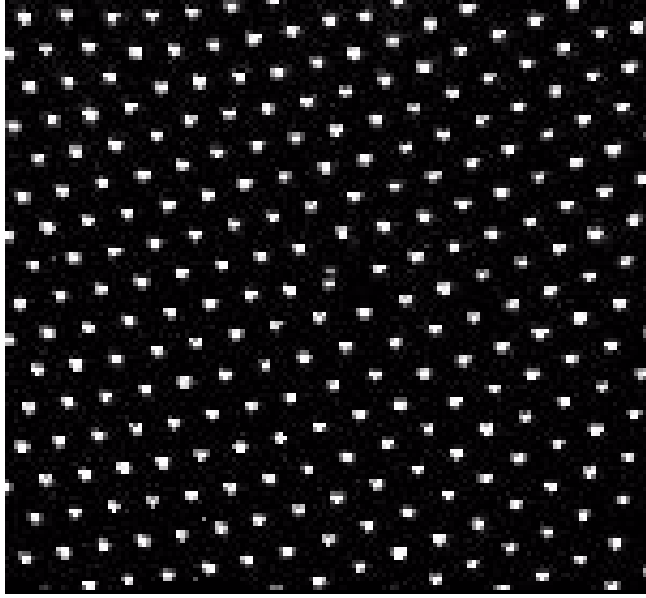
Chamber Power vs Input

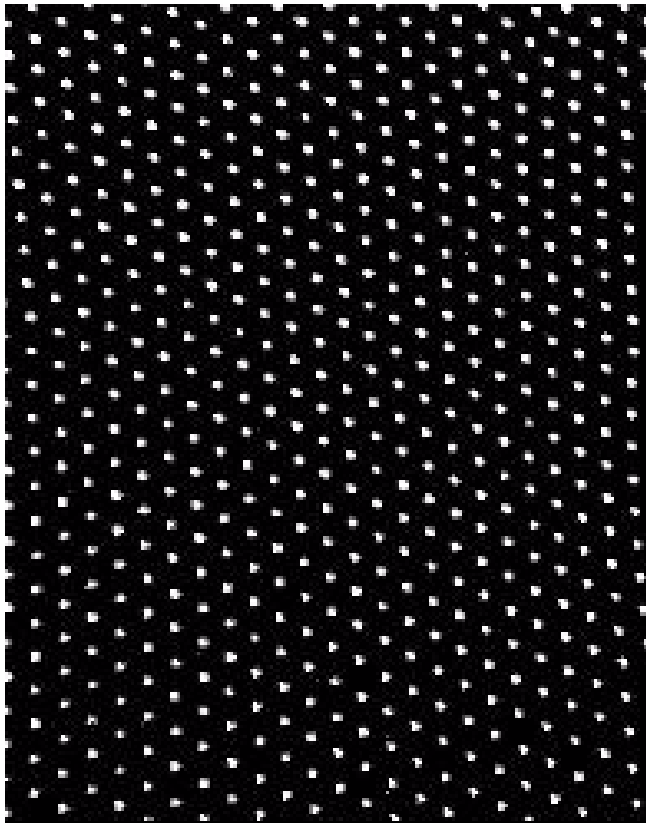


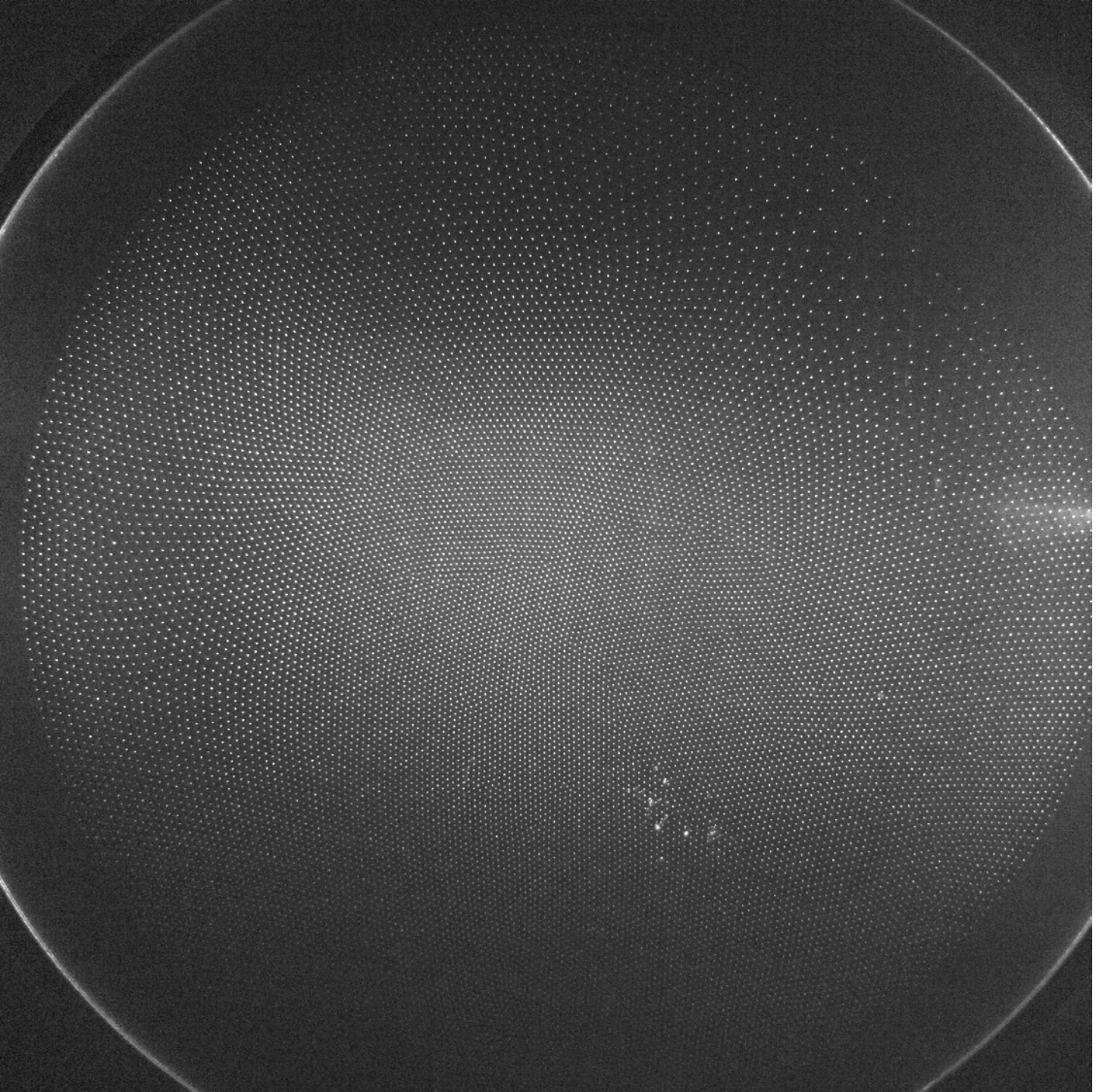
Self Bias



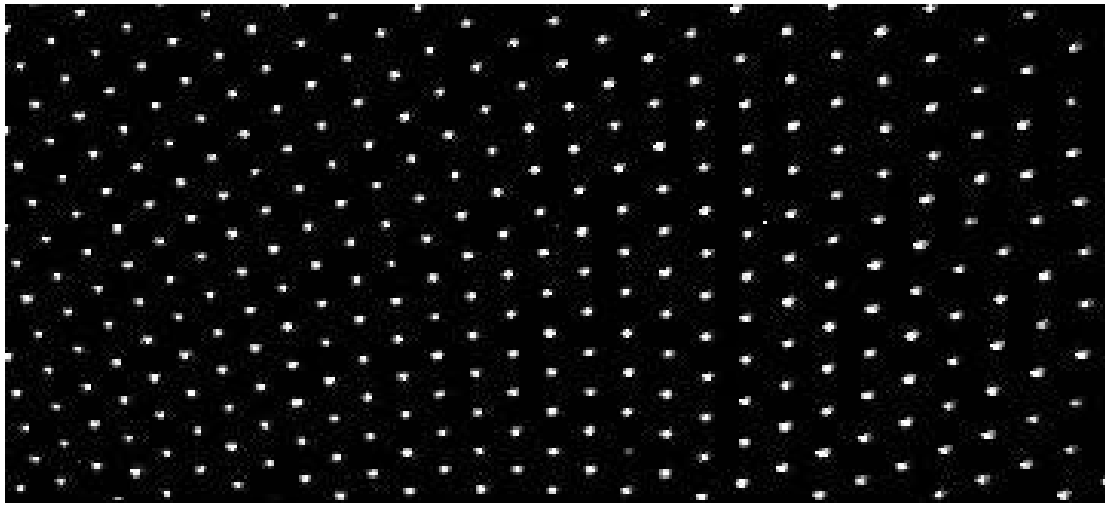

5.00 Pa
300 W



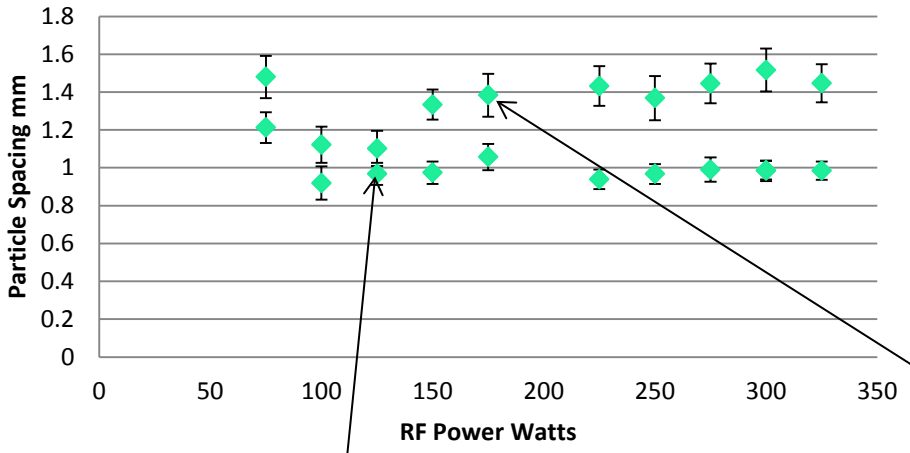




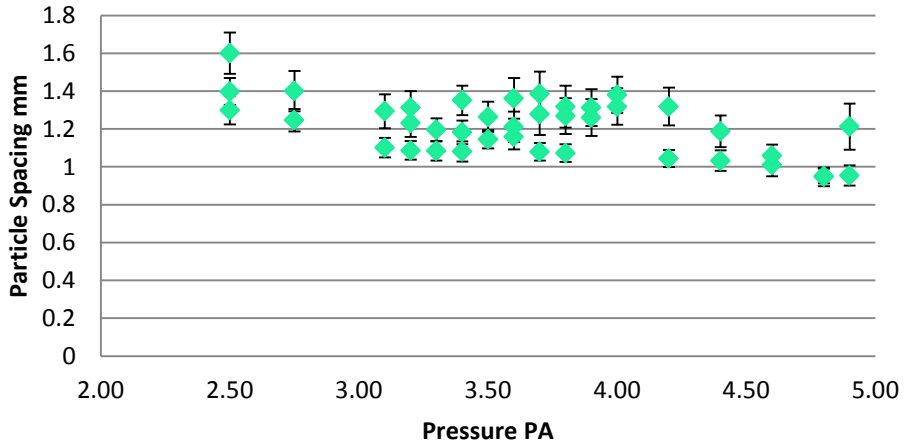
2.75 Pa
200 W

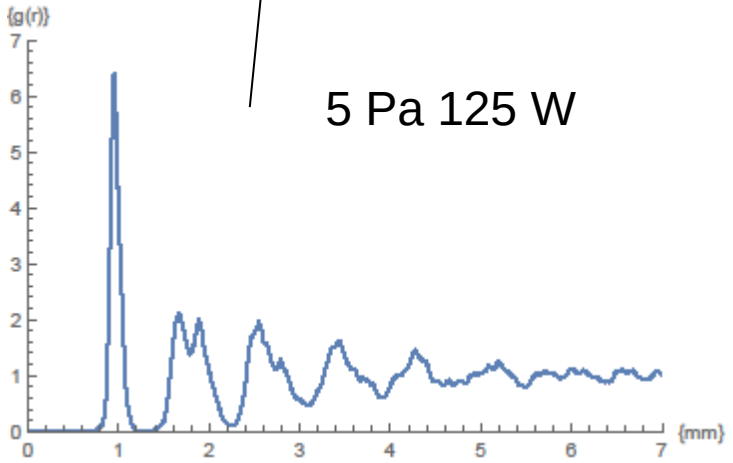


Particle Spacing vs Power

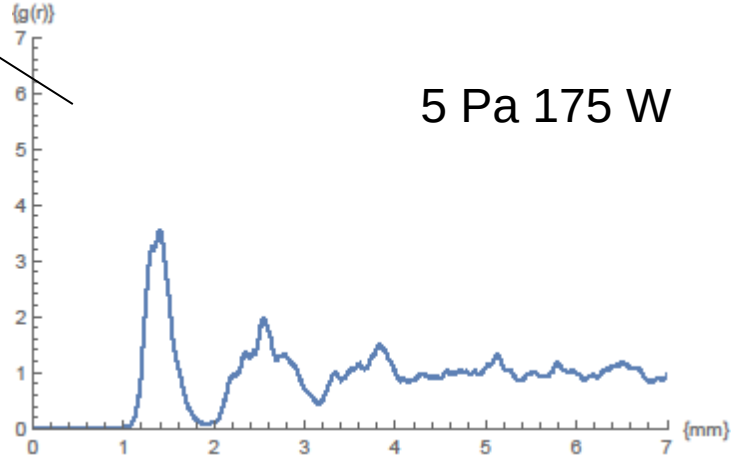


Particle Spacing vs Pressure



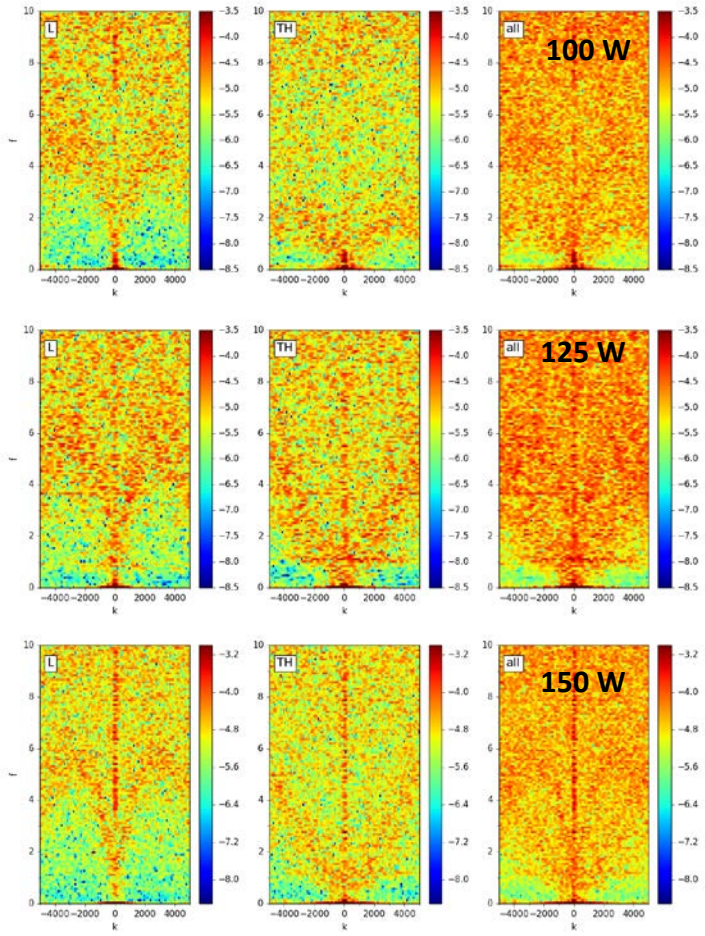


5 Pa 125 W

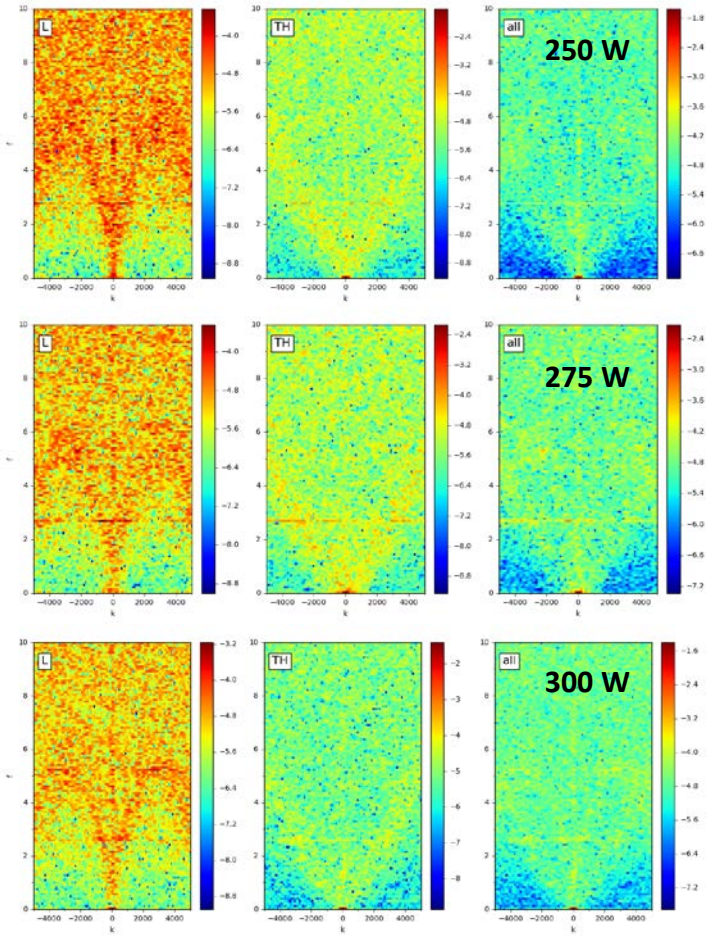


5 Pa 175 W

Sample Spectra at Powers

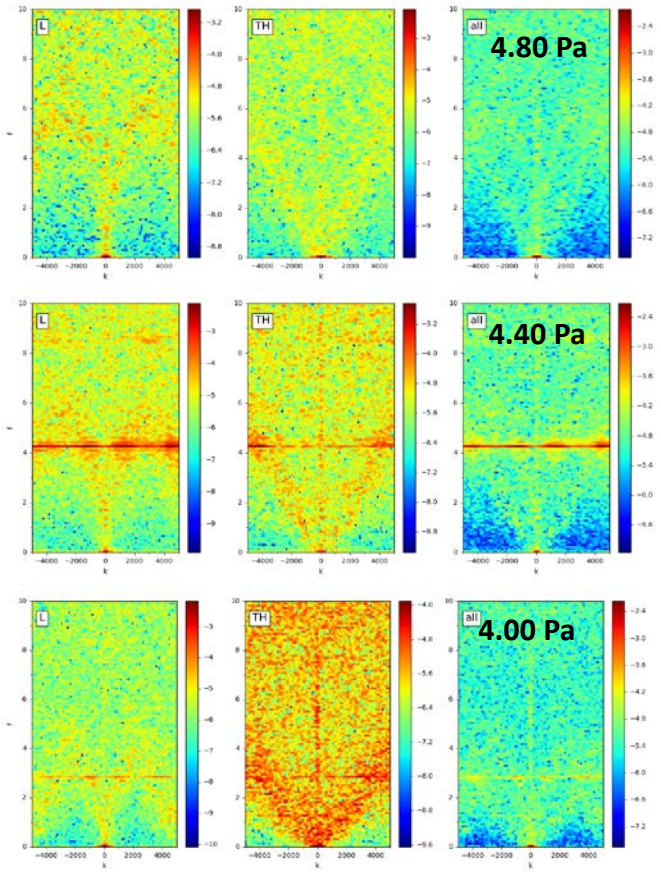


Longitudinal Transverse Together

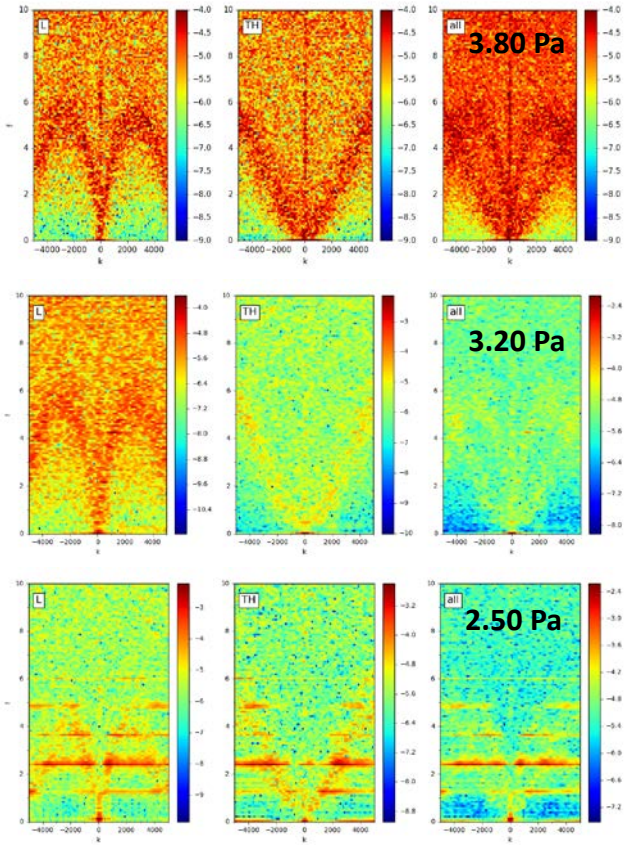


Longitudinal Transverse Together

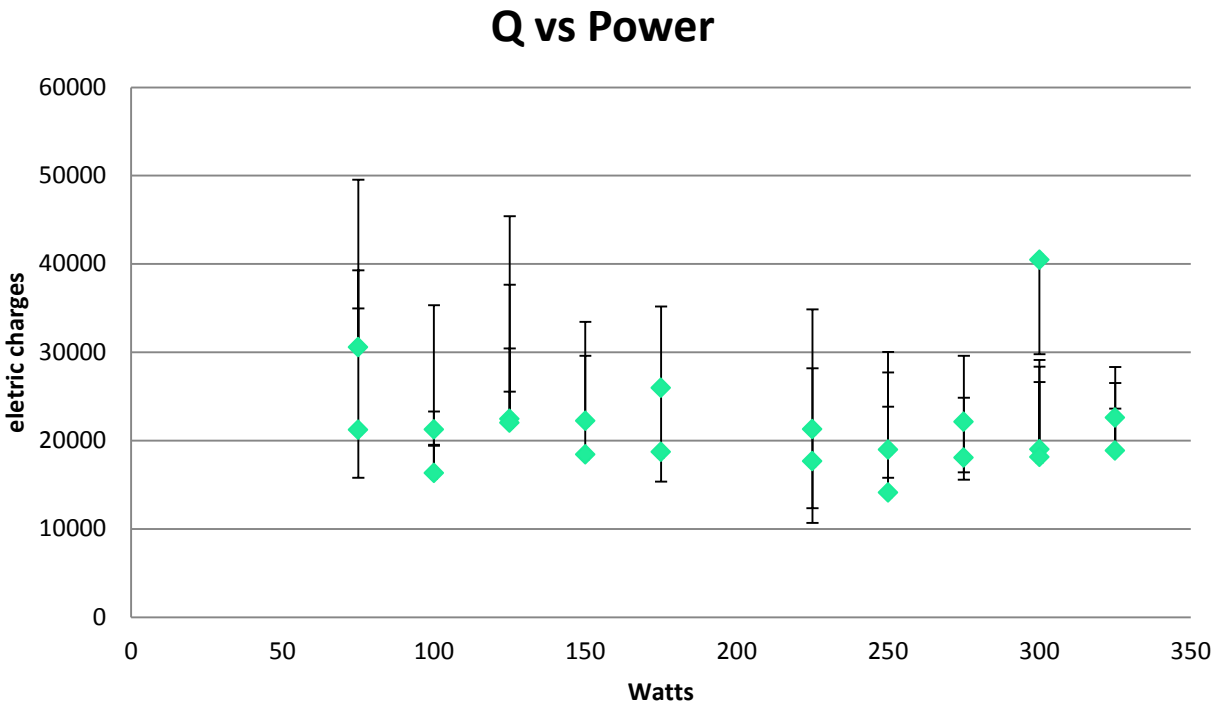
Sample Spectra at Pressures

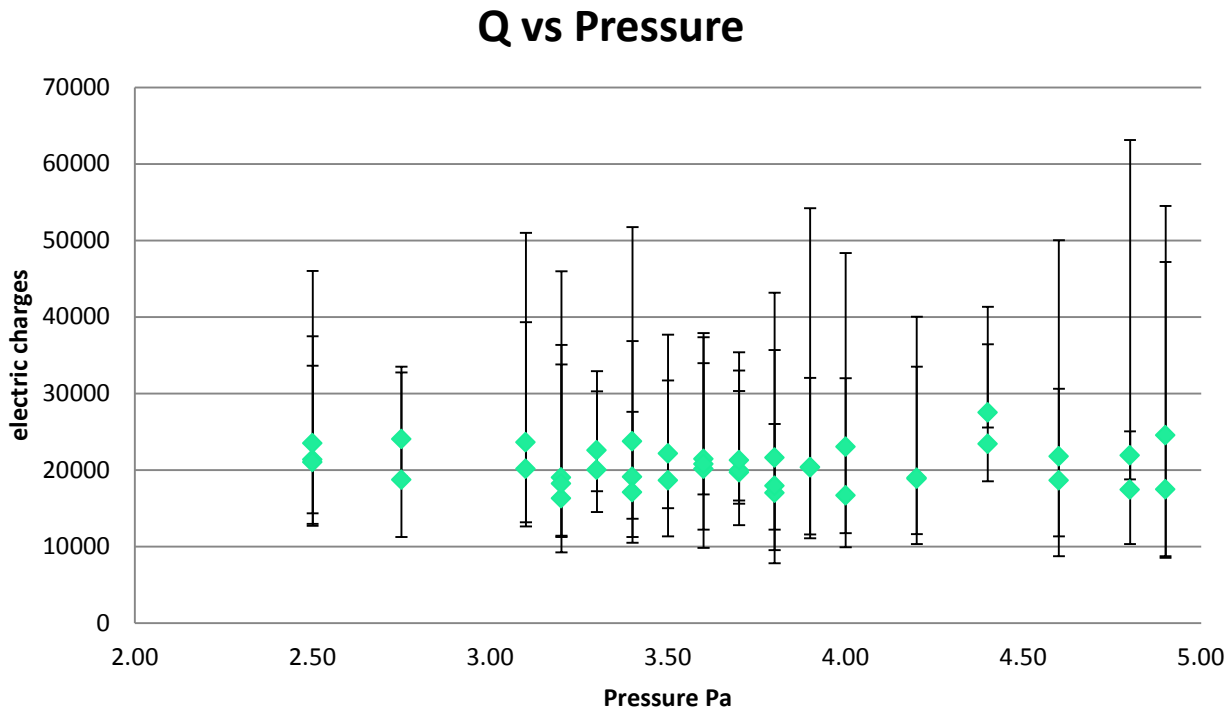


Longitudinal Transverse Together

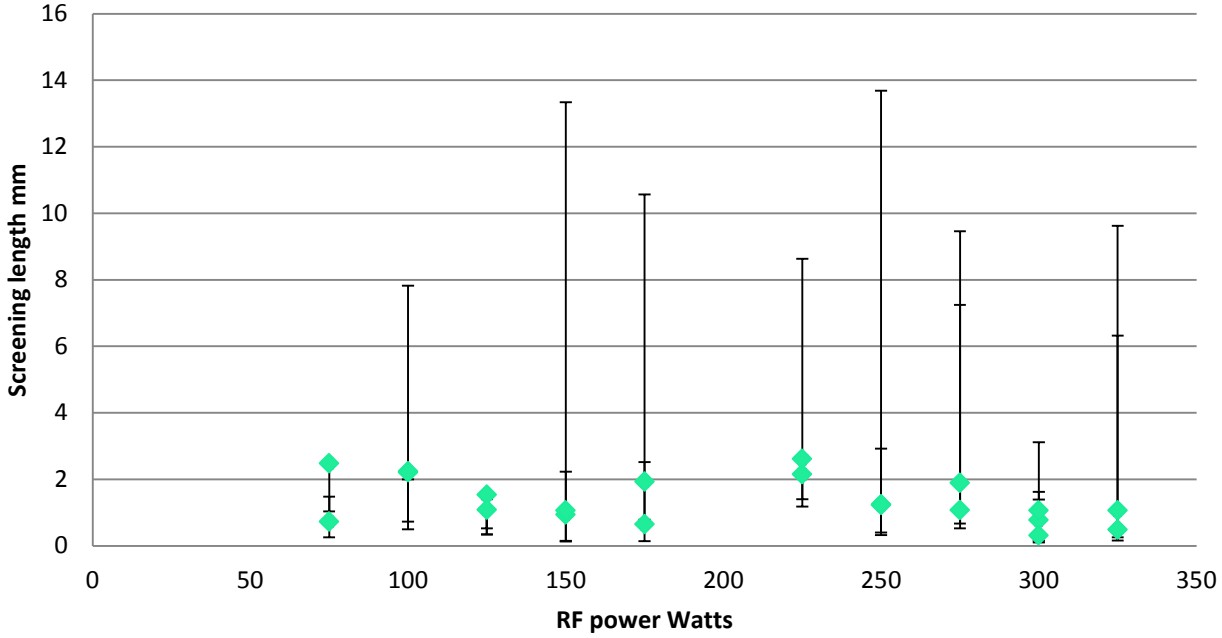


Longitudinal Transverse Together

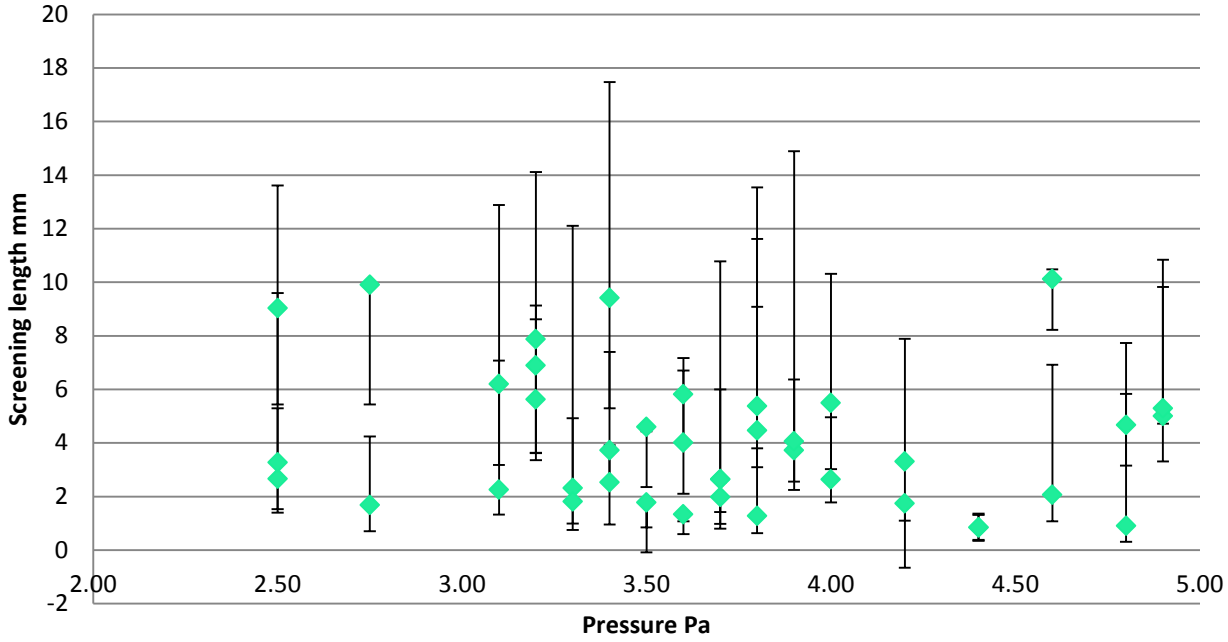

Q vs Power
eletric charges
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
300
350
Watts


Q vs Pressure
electric charges
70000
60000
50000
40000
30000
20000
10000
0
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Pressure Pa

Screening Length vs Power



Screening Length vs Pressure



Future Work

- Langmuir Probe measurements
- Bulk behavior analysis
- System-size dependence of thermal conductivity
- System-size dependence of dispersion relations
- Mode-coupling instability
- Possible photophoretic force experiment

Bulk Behavior

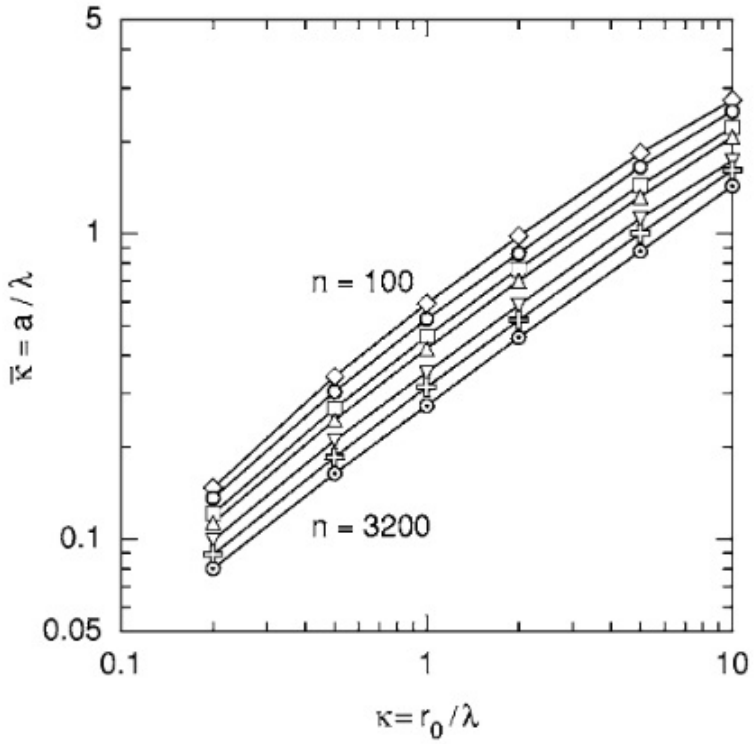


FIG. 1. Macroscopic shielding parameter $\bar{\kappa}=a/\lambda$ vs the Debye shielding parameter $\kappa=r_0/\lambda$ [Eq. (3)] for the finite Yukawa disk with $n=100$, 180, 320, 560, 1000, 1800, and 3200 particles.

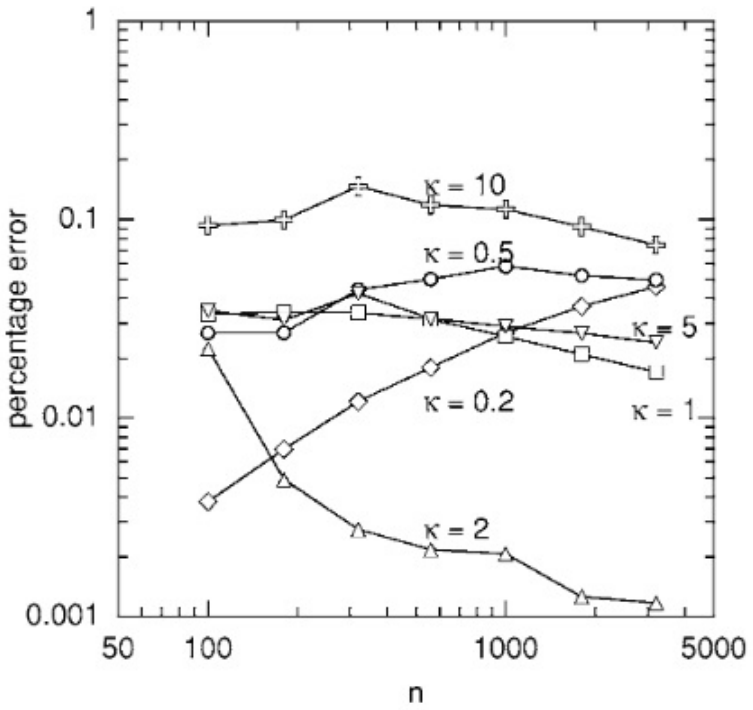


FIG. 2. Percentage error between the squared breathing frequency computed using Eq. (5) and exact eigenvalues vs the number of particles n and the Debye shielding parameter κ.

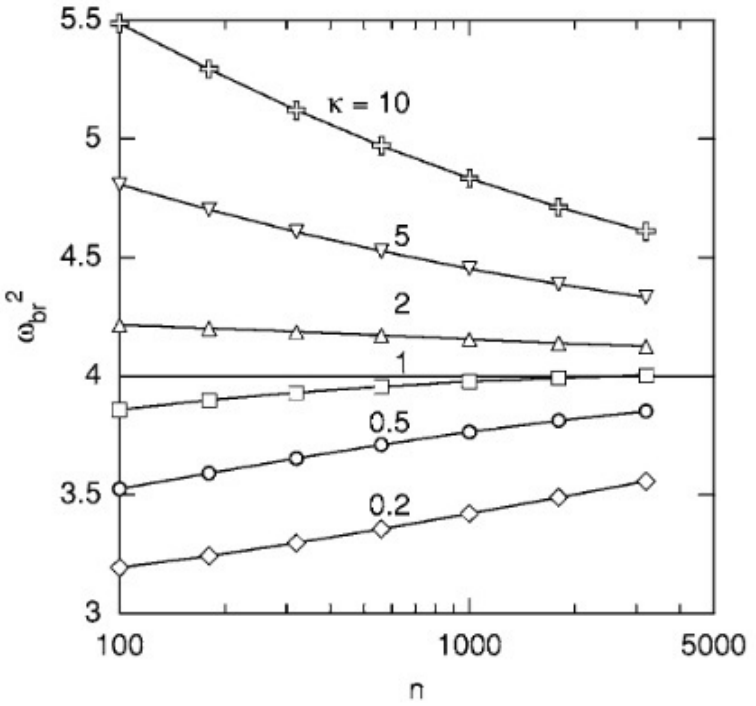


FIG. 3. Normalized, squared breathing frequency vs the number of particles n computed using the exact particle model for values of the Debye shielding parameter $\kappa=0.2$ to 10.

T. E. Sheridan, POP 14, 032108 (2007)

Thank You